



U.S. Department of Energy
Energy Efficiency and Renewable Energy

High Performance Design and Process Overview

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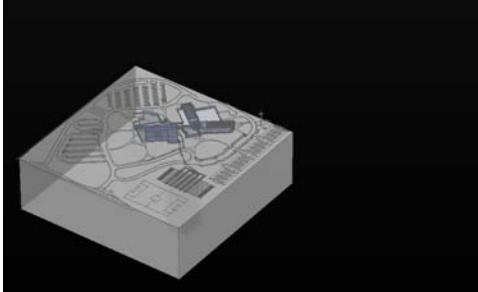
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Why?

- ✓ Improve Student Performance
- ✓ Increase Average Daily Attendance
- ✓ Increase Staff Retention
- ✓ Reduced Operating Cost
- ✓ Reduced Liability
- ✓ Reduced Environmental Impact
- ✓ Using the School as a Teaching Tool



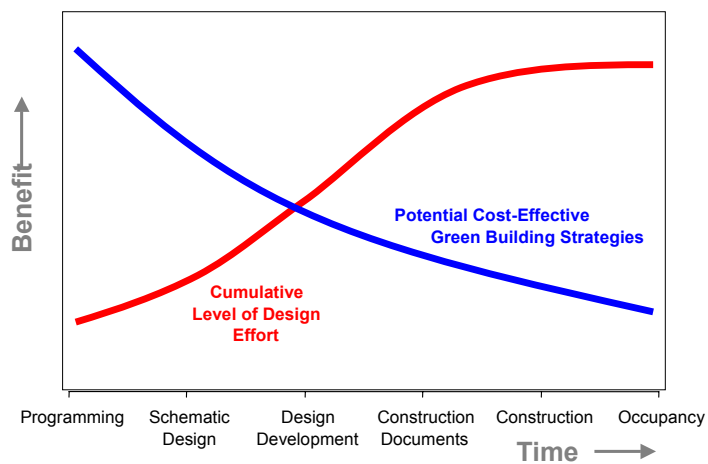
Components of High Performance Design



Site Design
Daylighting & Windows
Building Shell
Lighting/Electrical
HVAC
Renewable Energy
Water Conservation
Recycling
Transportation



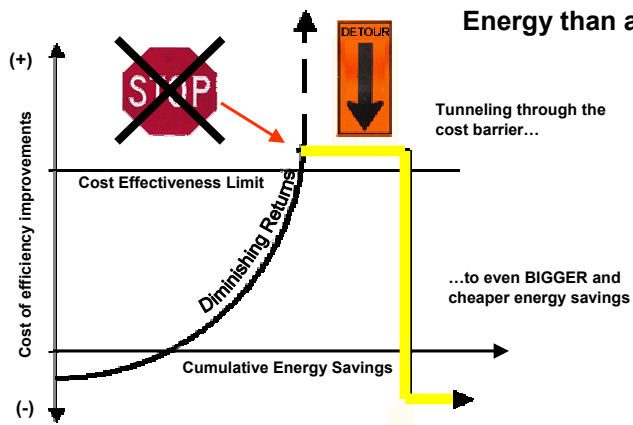
Integrated Building Design Process





Integrated Design

Using Integrated Design it Often
Costs Less to Save a lot of
Energy than a little Energy

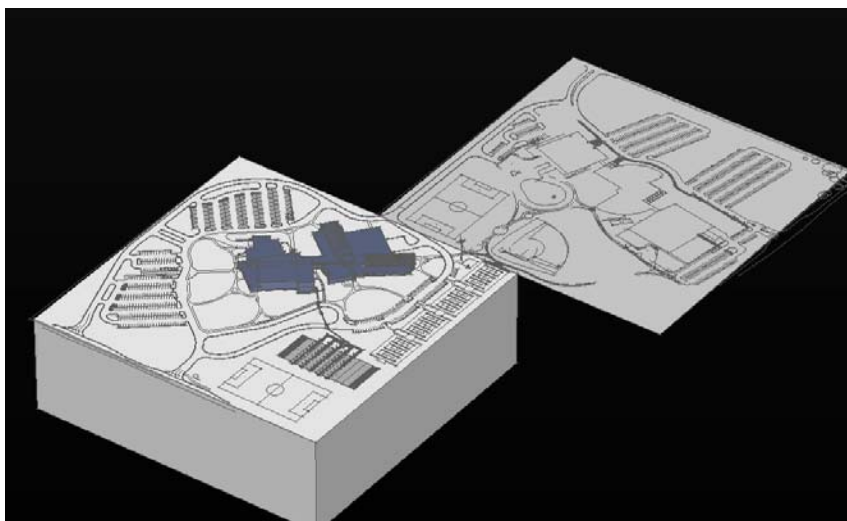


e.g. envelope, window, light shelves etc. impact system requirements

"Tunneling through the Cost Barrier" A. Lovins, Rocky Mountain Institute



Case Study





- Building simulation to optimize components
 - Wall insulation
 - Roof insulation
 - Windows



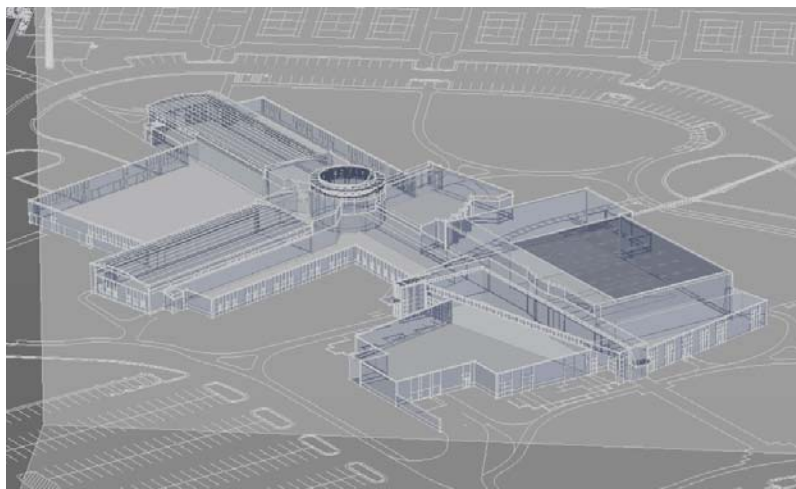


1. Reduce the HVAC loads.
2. Reduce the HVAC loads.
3. Reduce the HVAC loads.



- High Efficiency Lighting Systems
- Daylight Harvesting
- High Efficiency Transformers
- High Efficiency Motors
- Renewable Energy Systems





Typical High School Gymnasium



Typical Metal Halide

2.2 Watts/SF



T5 HO Fixture

1.3 Watts/SF

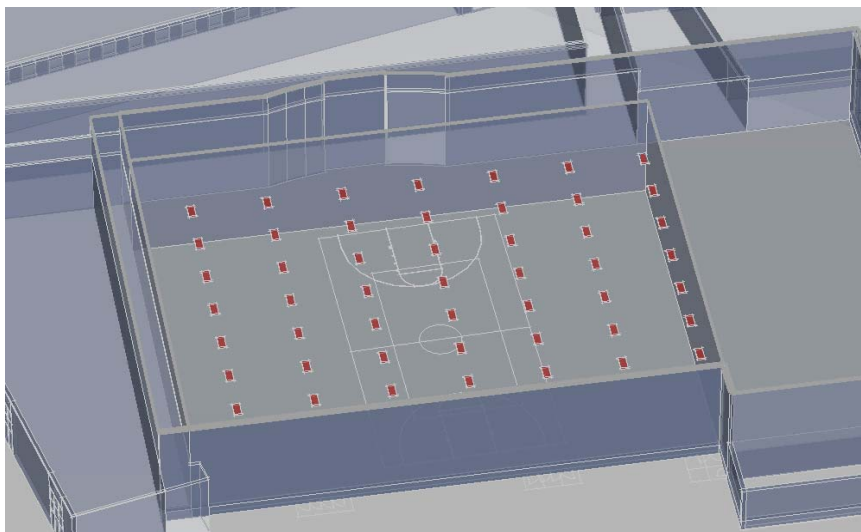
Improved lighting at a power density
reduction of 41%!



Gym Lighting Design



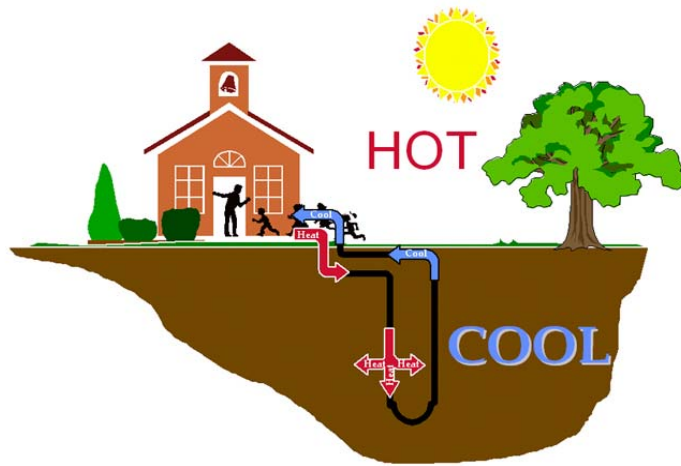
GeoExchange Systems





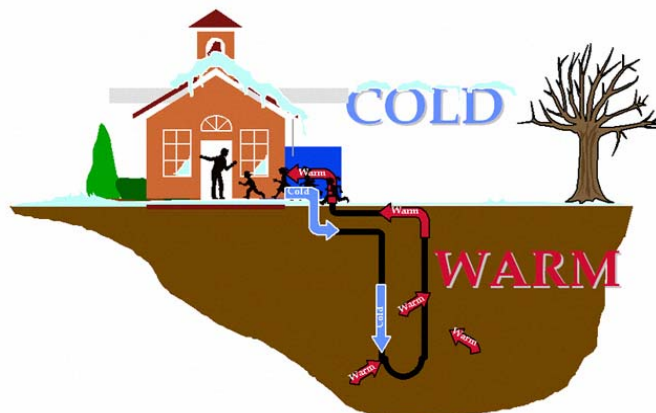
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GeoExchange Systems



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GeoExchange Systems





Typical Loop



Heat Exchanger Installation





Typical Trench



Pre-manufactured HDPE Vault





The "Boiler" Room



Web Browser Control Access

Zeeland Public Sch/High West/Graphics/FloorPlans/MainFloorPlan - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit

Address <http://207.74.23.84/ZeelandPublicSch/HighWest/Graphics/FloorPlans/MainFloorPlan> Go Links

Time Schedules

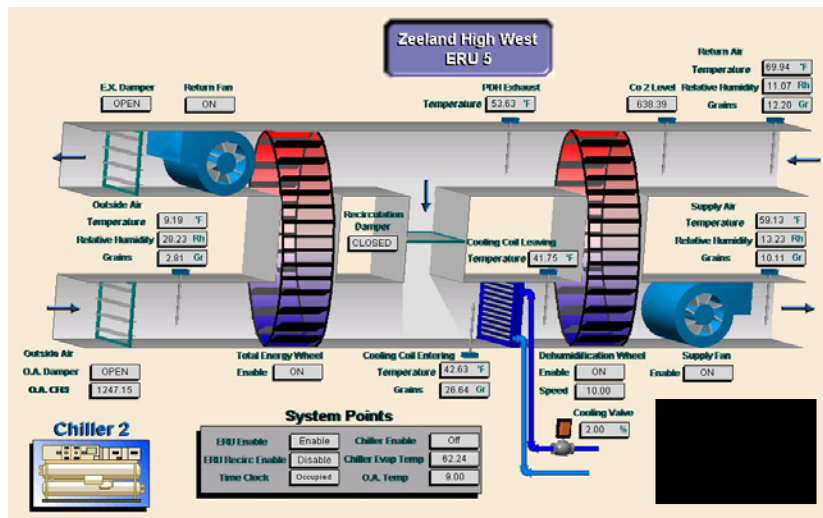
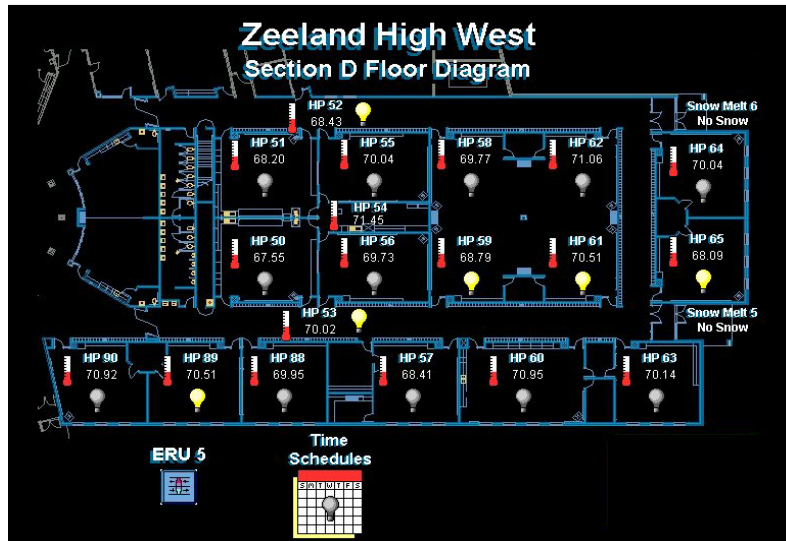
**Zeeland High West
Main Floor Diagram**

- Boiler Loop
- Heat Pump Loop
- Domestic Hot Water
- Power Distribution Panel
- Generator
- Outdoor Lighting
- Trend Logs
- Current Weather
- Building Humidity
- Wind Turbine
- Photo Cells

Done

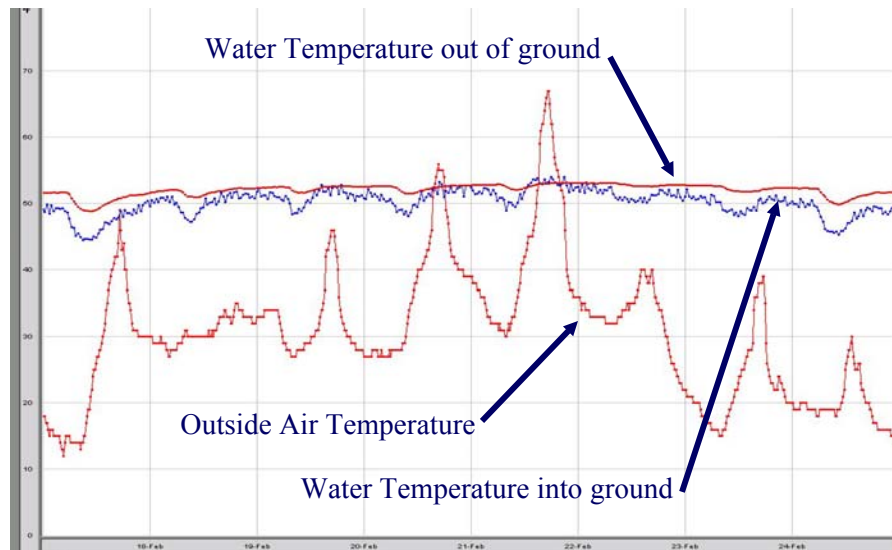
Start Internet

2:47 PM

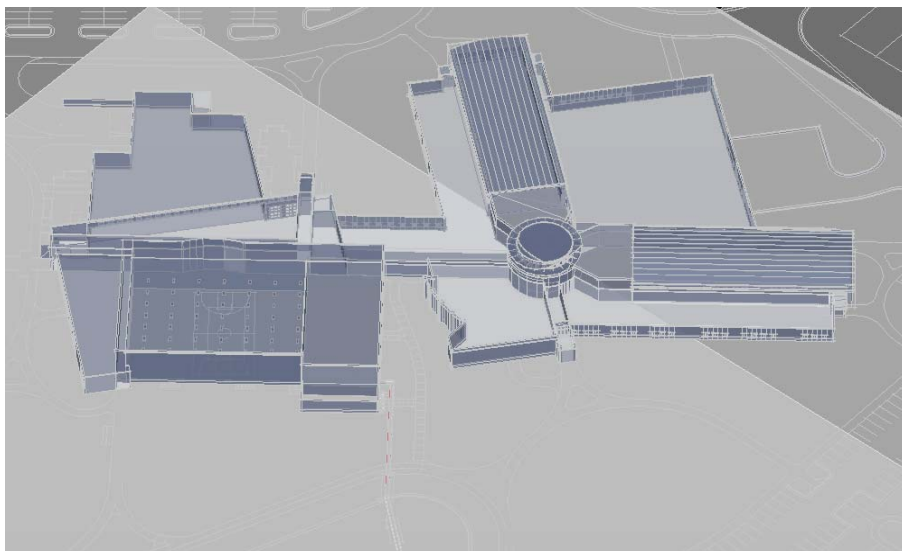




Web Browser Control Access



Renewable Energy Systems





Wind Turbine



Wind Turbine



10 kW

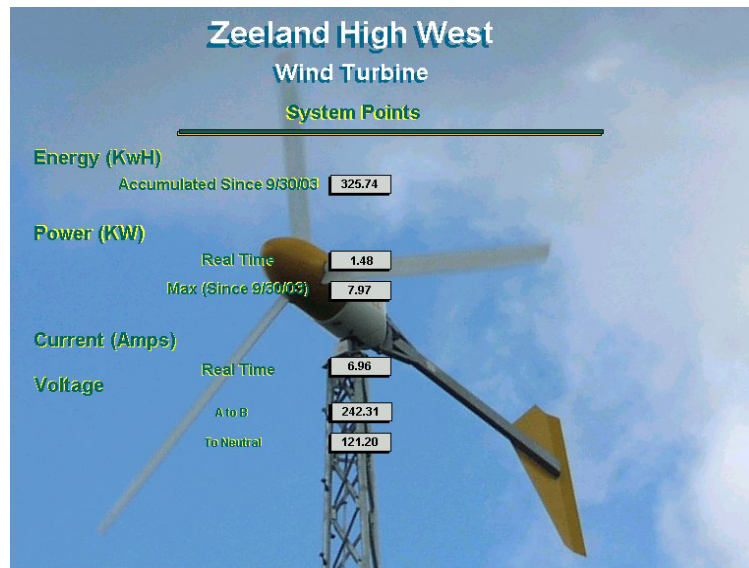
23' Diameter Rotor

85' tall tower

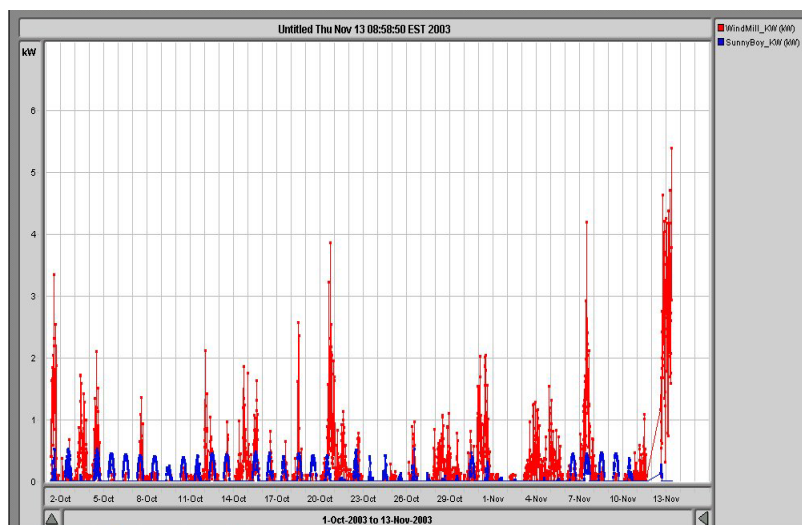
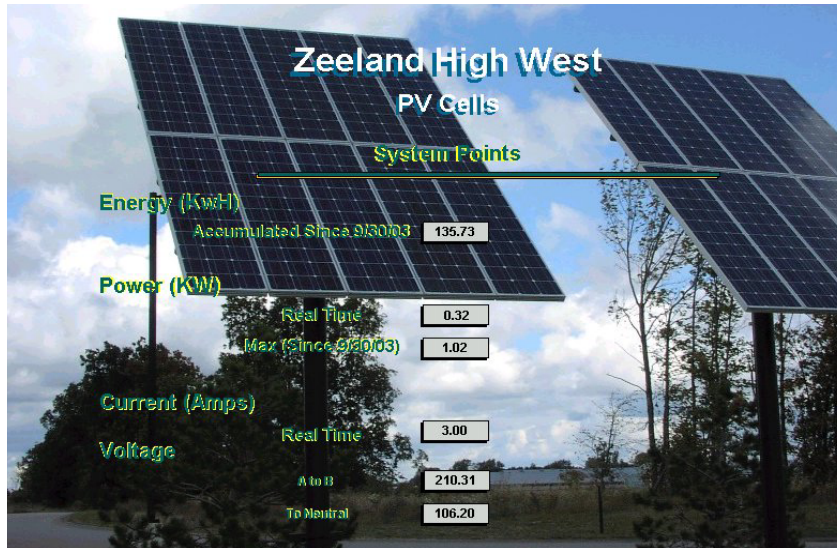
Real-time monitoring system

ZPS Payback – 4 to 6 years

Educational use – 20 to 30
year payback

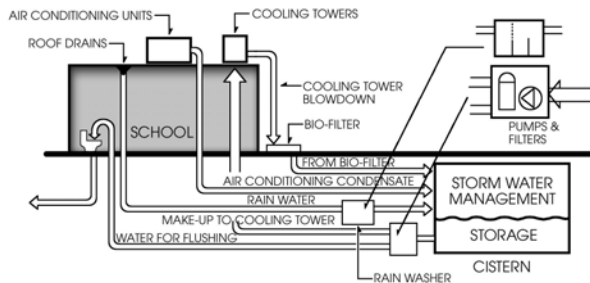


Photovoltaic systems convert sunlight directly to electricity with no pollution.





Water Efficiency



Site Design



- Use of plants that naturally occur within the region
- Native plants have developed resistance to disease, pest, drought and therefore will survive with less care



- Native plantings have many advantages over exotic species
- How much should we really be mowing/maintaining



- Standard approach vs. natural approach
- Perceptions for natural plantings are changing



Why natural plants?



Aesthetics

Natural landscapes are attractive and can offer seasonal interest throughout the year

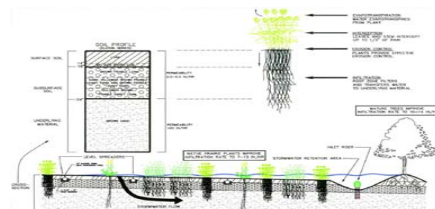
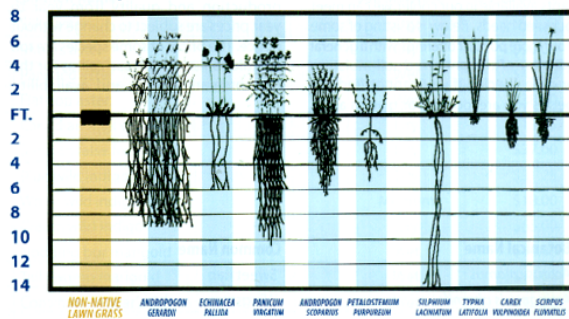
Prairie plantings can be planted in different heights, textures, colors etc.

Diversity of plantings will enhance the look



Why natural plants?

Comparison of Native Plants to Non-Native Lawn Grass



Reduced Runoff

Most turf grass plants possess very shallow root systems which are not capable of handling most rain events. Water that is not able to penetrate the soil is transported away. Native plantings have substantial root systems that filter large quantities of rain water and limit soil and fertilizers from moving offsite.



Why natural plants?

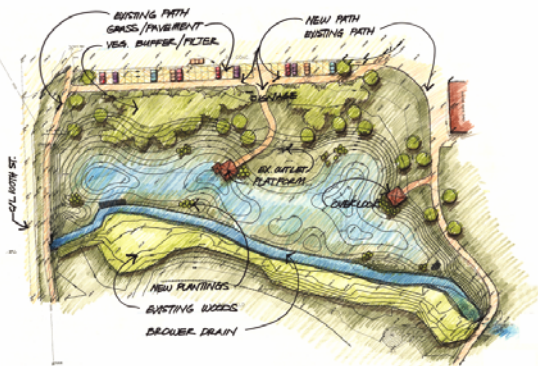


Wildlife

A planting scheme that includes a diverse mix of native species will create habitat for birds, insects and other animals.



Why natural plants?



Education

By utilizing native plantings students will experience the ecosystem in which they live. Plant identification and habitat development can be incorporated into the curriculum.



Case Study



•11 acres of East High School & West High School

•New image to the frontage along 96th Ave.

•Including areas that are hard to mow or unused for activities and traffic



How much savings?

Zeeland Public Schools Prairie Conversion

12/16/2003

Design costs will be performed hourly and are estimated at \$5000 to provide design, site administration, and oversight of the project

Table 1: Detailed Prairie Installation Costs*

	Year1	Year2	Year3	Year4	Year5	Year6	Year7	Year8	Year9	Year10
Site Preparation	\$ 3,000									
Seeding	\$ 22,000									
Live Plant Plugs**	\$ 23,000									
Maintenance	\$ 13,000	\$ 8,000	\$ 7,000	\$ 5,000	\$ 3,000					
Controlled Burn	\$ 5,000	\$ 5,000	\$ 5,000	\$ 5,000			\$ 5,000			\$ 5,000

Table 2: Comparison of Prairie vs. Turf Grass Costs

	Year1	Year2	Year3	Year4	Year5	Year6	Year7	Year8	Year9	Year10
Prairie*	\$ 61,000	\$ 13,000	\$ 12,000	\$ 10,000	\$ 5,000					\$ 5,000
Turf**	\$ 36,300	\$ 33,300	\$ 36,300	\$ 36,300	\$ 36,300	\$ 36,300	\$ 36,300	\$ 36,300	\$ 36,300	\$ 36,300
Annual Cost Difference	\$ 25,200	\$ 20,300	\$ 24,300	\$ 29,200	\$ 23,300	\$ 36,300	\$ 31,300	\$ 36,300	\$ 36,300	\$ 31,300

Table 3: Total Cost Savings to Zeeland Public Schools for 11 acre Prairie Conversion

	3-Year	5-Year	10-Year
Prairie Cost	\$ 49,000	\$ 45,000	\$ 109,000
Turf Cost	\$ 133,600	\$ 181,500	\$ 363,000
Total Cost Savings to ZPS	\$ 22,400	\$ 82,000	\$ 253,000

*These estimated costs assume conversion of 11 acres of turf grass into prairie by JF&W and include site preparation, seeding, plant plugs, and maintenance

**Estimated annual cost of \$3,300/acre for turf grass maintenance provided by ZPS. Costs have not been adjusted for inflation.

***Plant plug amount may vary, and may be delayed to year 2 in order to temper initial costs if desired. 8,000-10,000 plugs can be installed for this cost, depending on species.

Economics

Turf:

- Need to mow
- Need to water
- Need to fertilize
- Need to maintain irrigation system

Native Plantings:

- Bi-Annual burn or mowing is required



Where?



- Areas that are currently turf that we don't utilize for any particular purpose
- Storm detention areas
- Areas where turf has been difficult to maintain or take care of



Questions?



